

teague, Virginia; 20° 3 at Indianola, Texas, and 20° 1 at Norfolk, Virginia. The smallest monthly ranges are: 1° 3 at Eastport, Maine; 2° 7 at San Francisco, California; 5° 9 at Portland, Oregon; 6° 7 at Portland, Maine; 7° 2 at Sandy Hook, New Jersey, and 8° at New London, Connecticut. Observations were not made on account of ice during the month as follows: Grand Haven, Michigan from 4th to 10th; Cleveland, Ohio, from 1st to 22d, 23d to 26th and 31st; Toledo, Ohio, from 1st to 21st; Sandusky, Ohio, from 1st to 19th; Chicago, Illinois from 1st to 23d:

Temperature of water for March, 1884.

Station.	Temperature at bottom.		Range.	Average depth, feet and inches.		Mean temperature of the air at station.
	Max.	Min.				
Atlantic City, New Jersey.....	48.3	32.0	16.3	4 5		38.6
Alpena, Michigan*.....						
Augusta, Georgia.....	66.0	45.0	21.0	17 4		59.5
Baltimore, Maryland.....	48.6	35.8	12.8	9 0		44.0
Block Island, Rhode Island.....	41.5	29.4	12.1	8 3		35.0
Boston, Massachusetts.....	40.8	29.9	10.9	22 2		33.5
Buffalo, New York*.....						
Canby, Fort, Washington.....	51.0	40.7	10.3	16 6		44.0
Cedar Keys, Florida.....	76.0	50.3	25.7	12 2		66.7
Charleston, South Carolina.....	65.6	52.9	14.7	40 11		59.8
Chicago, Illinois†.....	42.3	38.3	4.0	8 7		34.2
Chincoteague, Virginia.....	53.5	34.5	21.0	4 9		42.3
Cleveland, Ohio.....	38.1	37.4	0.7	14 0		33.6
Detroit, Michigan*.....						
Delaware Breakwater, Delaware.....	54.1	27.1	27.0	8 7		40.1
Duluth, Minnesota.....						
Eastport, Maine.....	33.3	32.0	1.3	14 9		28.2
Escanaba, Michigan*.....						
Galveston, Texas.....	71.5	50.3	21.3	12 1		64.8
Grand Haven, Michigan†.....	44.3	32.1	12.2	19 0		32.0
Indianola, Texas.....	72.8	52.5	20.3	9 5		65.7
Jacksonville, Florida.....	73.0	59.0	14.0	18 0		66.3
Key West, Florida.....	82.2	69.0	13.2	17 7		74.0
Mackinaw City, Michigan*.....						
Macon, Fort, North Carolina.....	64.5	49.0	15.5	2 10		54.8
Marquette, Michigan*.....						
Milwaukee, Wisconsin*.....						
Mobile, Alabama.....	66.0	52.0	14.0	16 1		62.2
New Haven, Connecticut.....	41.6	29.9	11.7	15 3		33.6
New London, Connecticut.....	41.8	33.8	8.0	12 2		35.8
New York City.....	44.0	31.1	12.9	10 2		37.5
Norfolk, Virginia.....	58.5	38.4	20.1	16 7		50.3
Pensacola, Florida.....	68.1	57.9	10.2	17 6		63.1
Portland, Maine.....	36.4	29.7	6.7	16 2		33.7
Portland, Oregon.....	48.6	42.7	5.9	56 4		45.4
Provincetown, Massachusetts.....	41.2	31.5	9.7	10 5		34.6
Sandusky, Ohio.....	44.0	34.3	9.3	10 10		34.9
Sandy Hook, New Jersey.....	41.4	34.2	7.2	1 7		38.0
San Francisco, California.....	55.4	52.7	2.7	39 3		54.0
Savannah, Georgia.....	65.8	48.8	17.0	10 4		61.7
Smithville, North Carolina.....	64.1	49.0	15.1	10 0		56.2
Toledo, Ohio.....	48.5	38.6	9.9	12 6		35.2
Wilmington, North Carolina.....	63.2	47.3	15.9	19 7		58.1

\* Frozen entire month. † Frozen part of month: see text.

## VERIFICATIONS.

### INDICATIONS.

The detailed comparison of the tri-daily indications for March, 1884, with the telegraphic reports for the succeeding twenty-four hours, shows the general average percentage of verifications to be 82.67 per cent. The percentages for the four elements are: weather, 87.26; direction of the wind, 76.51; temperature, 80.56; barometer, 87.94 per cent. By geographical districts they are: for New England, 83.60; middle Atlantic states, 83.48; south Atlantic states, 84.36; eastern Gulf states, 81.42; western Gulf states, 79.73; lower lake region, 84.00; upper lake region, 83.68; Ohio valley and Tennessee, 84.15; upper Mississippi valley, 82.96; Missouri valley, 78.94; north Pacific coast region, 72.37; middle Pacific coast region, 88.16; south Pacific coast region, 92.11. There were five omissions to predict, out of 3,448 or 0.15 per cent. Of the 3,443 predictions that have been made, one hundred and eleven, or 3.22 per cent., are considered to have entirely failed; one hundred and forty-four, or 4.18 per cent., were one-fourth verified; four hundred and fifty-one, or 13.10 per cent., were one-half verified; six hundred and eight, or 17.66 per cent., were three-fourths verified; 2,129, or 61.84 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

### CAUTIONARY SIGNALS.

During March, 1884, two hundred and forty-six cautionary signals were ordered. Of these, two hundred, or 81.30 per cent., were justified by winds of twenty-five miles or more, per hour, at or within one hundred miles of the station. Sixty-two cautionary off-shore signals were displayed, of which number, fifty-four, or 87.09 per cent., were fully justified both as to direction and velocity; sixty-one, or 98.38 per cent., were justified as to direction; and fifty-five, or 88.71 per cent., were justified as to velocity. Three "northwest" signals were displayed on the lakes; all of these were justified both as to direction and velocity. Three hundred and eleven signals of all kinds were displayed, two hundred and fifty-seven, or 82.60 per cent., being fully justified. These do not include signals ordered at display stations, where the velocity of the wind is only estimated. Of the above cautionary off-shore signals, sixty were changed from cautionary; the "northwest" signals were also changed from cautionary. In seventy cases, winds of twenty-five miles or more, per hour, were reported for which no signals were ordered.

The verification of railway signals issued during the month by the "Ohio Meteorological Bureau," Professor T. C. Mendenhall, Director, was as follows:

Temperature, 92 per cent.; precipitation, 88 per cent.

The signals above referred to consist of colored symbols displayed from the sides of the baggage cars on various railroads in Ohio, and represent the daily forecasts as telegraphed from the office of the Chief Signal Officer to said bureau.

### ATMOSPHERIC ELECTRICITY.

#### AURORAS.

An auroral display which occurred on the evening of the 28th was observed throughout the northern part of the United States. This was the most extensively observed display of the month, and appears to have been most brilliant from the lake region westward to the Pacific. The display occurring on the evening of the 1st was generally observed in the lake region and New England. On the 25th a display was observed at New River Inlet, North Carolina, which was not reported from any other station. The following reports relate to the display of the 28th:

Provincetown, Massachusetts: auroral display from 10.50 p. m. of the 28th, until midnight, consisting of faint beams reaching nearly to the zenith.

Fall River, Massachusetts: a brilliant auroral display occurred on the 28th, lasting from 8 to 11 p. m. The auroral light extended over about 60° of the northern horizon and beyond the zenith.

New Haven, Connecticut: an auroral arch, extending over about 100° of the northern horizon, was visible in the northern sky at 7.30 p. m. of the 28th. The display was of moderate brilliancy and was obscured by clouds at 10 p. m.

Rochester, New York: aurora from 7.20 to 11 p. m. of the 28th; very bright at 9 p. m., when beams of pale yellow color extended upward 65° from the horizon.

Oswego, New York: aurora at 8.30 p. m. of 28th, consisting of a band of white light which extended from northwest to east. The display reached its maximum brilliancy at 8.55 p. m. and disappeared at 9.30 p. m.

Alpena, Michigan: aurora at 8.15 p. m. of 28th, consisting of a diffuse light with a few pale streamers having an apparent motion from east to west.

Duluth, Minnesota: faint aurora at 9.45 p. m. of the 28th, consisting of flashes of pale green light, at times reaching upward to the zenith.

Escanaba, Michigan: a brilliant auroral display occurred on the 28th. It was first seen at 7.54 p. m. Four minutes later an arch formed near the horizon and gradually moved upward until it reached a point 15° south of the zenith. When the arch reached the zenith, bright, yellow beams, having a swaying motion, shot upward from the northern horizon. The display had entirely faded away at 9.50 p. m.

Bismarek, Dakota: an auroral display, consisting of beams extending from the horizon to the zenith, was observed from 7.30 to 11.30 p. m. of the 28th.

Fort Yates, Dakota: a brilliant auroral display occurred on the evening of the 28th.

Fort Assinaboine, Montana: a partial auroral display was observed from 4.30 until daylight on the morning of the 28th. At 7.40 p. m. of the same date an auroral arch extended from the eastern horizon through the zenith to within 4° of the western horizon. The influence of latter display on the telegraph wires was very perceptible.

Helena, Montana: from 8 to 10.30 p. m. of the 28th were observed bright auroral beams of a variety of tints, and having a tremulous motion.

Saint Vincent, Minnesota: an auroral display was visible from 8 p. m. of the 28th until the early morning of the 29th. Soon after it first appeared, a corona formed at a point south of the zenith, and continued until 11 p. m., when the display assumed the form of an arch.

Dayton, Washington Territory: aurora at 9 p. m. of the 28th, the display being partially obscured by clouds.

Lewiston, Idaho: aurora visible from 7.30 to 9.10 p. m. on the 28th.

Port Angeles, Washington Territory: an aurora was visible in the northern sky at 7.45 p. m. of the 28th. At 8 p. m. there were observed two well-defined segments, between which was a band of straw colored light one and one-half degrees in width. The aurora reached its maximum brilliancy at 10 p. m., when there was a beautiful display of "merry dancers." At 11.20 p. m. the display had become very faint.

Fort Canby, Washington Territory: a brilliant aurora was observed from 9 to 10 p. m. on the 28th. The display consisted of three streamers which extended to an altitude of 60° from a base of bright bluish-pink color.

Other stations reporting the display of the 28th are as follows: Polo, Illinois; Cresco and Manchester, Iowa; Cambridge, Massachusetts; Lansing and Manistique, Michigan; Chester and Northfield, Minnesota; Auburn, Ithaca, Madison Barracks, North Volney, and Palermo, New York; Montreal, Province of Quebec; Toronto, Province of Ontario; Bainbridge Island and Pleasant Grove, Washington Territory; Embarrass, Franklin, Madison, Manitowoc, and Wausau, Wisconsin.

Auroral displays occurred on other dates during the month as follows:

1st.—Sycamore, Illinois; Cresco, Iowa; Cornish, Eastport, Gardiner, Orono, and Portland, Maine; Boston and Cambridge, Massachusetts; Alpena, Escanaba, Lansing, Mackinaw City, Marquette, Manistique, Swartz Creek, Thornville, and Traverse City, Michigan; Johnson, Nebraska; Mount Washington, New Hampshire; Syracuse, Palermo, and Menand Station (near Albany), New York; Leetsdale, Pennsylvania; Block Island, Narragansett Pier and Point Judith, Rhode Island; Burlington, Vermont; Madison, Sussex, and Wausau, Wisconsin.

2d.—Fort Totten, Dakota; Eastport, Gardiner, and Portland, Maine; Boston and Provincetown, Massachusetts; Mount Washington, New Hampshire; Syracuse, New York.

6th.—Marquette, Michigan.

15th.—Sandwich, Illinois.

19th.—Boston, Massachusetts; Mackinaw City, Manistique, and Marquette, Michigan; Manitowoc, Wisconsin; Chatham, New Brunswick and Sidney, Nova Scotia.

20th.—Fort Buford, Dakota; Riley, Illinois; Cornish, Gardiner, and Orono, Maine; Fort Brady, Michigan; Chatham, New Brunswick; Halifax, Nova Scotia; Charlottetown, Prince Edward Island; Burlington and Newport, Vermont; Embarrass and Madison, Wisconsin.

21st.—Eastport and Orono, Maine; Boston, Massachusetts; Fort Brady, Manistique, and Traverse City, Michigan; Chatham, New Brunswick; Sidney, Nova Scotia; Charlottetown, Prince Edward Island; Point Judith, Rhode Island; Burlington and Newport, Vermont.

22d.—Gardiner, Maine; Cambridge, Massachusetts; Newport, Vermont.

24th.—Fort Meade, Dakota: between 7 and 8 p. m., in the northeastern sky.

25th.—New River Inlet, North Carolina: an aurora was observed from 7 to 8 p. m., consisting of a yellowish light, which extended along the horizon from north to northeast and to an altitude of 20°.

27th.—Washington City, District of Columbia: a brilliant aurora was observed at 4 a. m. It consisted of a steady glow of light, of greenish tinge, in the northern sky, extending upward to the zenith.

29th.—Toronto, Province of Ontario.

#### ATMOSPHERIC ELECTRICITY INTERFERING WITH TELEGRAPHIC COMMUNICATION.

Fort Stanton, New Mexico: an intense electrical storm prevailed on the 13th. Between 12 m. and 1.30 p. m. the telegraph wires were so affected as to interrupt communication.

Fort Assinaboine, Montana: telegraphic communication was interrupted by atmospheric electricity on the 26th.

Dodge City, Kansas: 10th, 27th.

Fort Elliott, Texas: during a high southwesterly wind on the 27th the atmosphere was so charged with electricity that the insulated wire, without battery connection, emitted large electric sparks, accompanied by a loud cracking noise.

Cantonment, Indian Territory: the atmosphere was highly charged with electricity on the 31st.

Fort Reno, Indian Territory: during the wind storm of the 27th, the atmospheric electricity was of sufficient intensity to give a severe shock on touching the telegraph wire or binding posts of the instruments.

The observer on the summit of Mount Washington, New Hampshire, reports that on the evening of the 26th, all pointed objects were tipped with light. On holding up the hands slight shocks were experienced. This phenomenon was first noticed at 8.40 p. m., and continued for about one hour, during which time a light snow fell and a dense fog prevailed.

#### THUNDER-STORMS.

Thunder storms were reported in the various districts, as follows:

*New England.*—9th, 21st, 24th, 26th, 28th.

*Middle Atlantic states.*—8th, 9th, 12th, 19th, 25th, 26th, 28th.

*South Atlantic states.*—6th to 9th, 11th to 14th, 18th to 20th, 23d to 26th, 28th, 29th.

*Florida peninsula.*—8th to 14th, 17th to 20th, 22d, 24th to 26th.

*Eastern Gulf states.*—1st, 3d, 6th, 7th, 11th to 13th, 17th to 19th, 23d to 26th.

*Western Gulf states.*—4th to 7th, 11th, 12th, 16th to 18th, 20th to 25th, 27th, 30th, 31st.

*Rio Grande valley.*—Rio Grande City, Texas, 16th to 18th, 20th, 30th 31st.

*Tennessee.*—7th, 8th, 11th, 12th, 19th, 22d, 24th, 25th.

*Ohio valley.*—8th, 11th, 21st, 24th, 25th, 28th.

*Lower lake region.*—10th to 12th, 22d, 25th, 28th.

*Upper lake region.*—2d, 5th, 9th to 11th, 15th, 25th, 28th, 30th, 31st.

*Extreme northwest.*—Fort Buford, Dakota, 25th, 26th.

*Upper Mississippi valley.*—10th, 11th, 21st, 22d, 24th, 25th, 27th, 28th, 30th, 31st.

*Missouri valley.*—10th, 16th, 17th, 19th to 22d, 24th, 25th, 27th, 28th, 30th, 31st.

*Northern slope.*—Cheyenne, Wyoming, 20th; Fort Shaw, Montana, 26th; North Platte, Nebraska, 27th, 30th; Fort Meade, Dakota, 30th.

*Middle slope.*—6th, 9th, 10th, 15th, 16th, 20th to 23d, 27th, 28th, 30th, 31st.

*Southern slope.*—6th, 16th to 18th, 21st to 23d, 30th, 31st.

*Southern plateau.*—6th, 15th, 16th, 26th, 30th.

*Middle plateau.*—Salt Lake City, Utah, 5th, 6th, 10th; Logan, Utah, 6th.

*Northern plateau.*—Boisé City, Idaho, 25th.

*California.*—Los Angeles and Princetown, 4th; Sacramento, 9th; San Francisco and Oakland, 25th.

The following instances of damage by lightning have been reported:

Indianapolis, Indiana: the electrical display accompanying the thunder storm of the 11th was very unusual. A building in this city was damaged by the lightning and several persons were stunned.

Austin, Texas: during a thunder storm on the 17th, several objects in this city were struck by lightning.

Montgomery, Alabama: the telephone wires in this city were damaged by lightning during the thunder storm on the night of the 23-24th.

#### OPTICAL PHENOMENA.

##### SOLAR HALOS.

Solar halos have been observed in the various districts on the following dates:

*New England.*—2d to 8th, 10th, 11th, 13th to 15th, 17th to 19th, 21st to 25th, 29th to 31st.

*Middle Atlantic states.*—1st, 10th to 12th, 16th, 18th, 22d, 25th, 28th.

*South Atlantic states.*—3d, 4th, 9th, 10th, 12th, 17th to 20th, 22d, 24th, 26th to 28th.

*Florida peninsula.*—Archer, 24th.

*Eastern Gulf states.*—18th, 20th, 24th.

*Western Gulf states.*—3d, 10th, 16th, 18th, 21st, 22d, 25th, 27th, 30th.

*Tennessee and Ohio valley.*—4th, 9th, 12th, 16th, 17th, 22d to 24th, 26th to 28th, 31st.

*Lower lake region.*—1st to 3d, 5th, 6th, 10th, 13th, 14th, 16th, 21st, 22d, 24th.

*Upper lake region.*—1st, 4th, 6th, 8th, 10th, 14th, 16th, 20th, 25th, 26th, 28th, 30th.

*Upper Mississippi valley.*—2d, 3d, 6th, 7th, 12th to 16th, 21st to 23d, 27th, 29th.

*Missouri valley.*—5th, 8th, 10th, 11th, 13th, 16th, 22d.

*Middle slope.*—11th, 14th, 19th, 20th, 23d, 30th.

*Southern slope.*—Fort Stockton, Texas, 19th.

*Middle plateau.*—Salt Lake City, Utah, 13th; Nephi, Utah, 22d; Carson City, Nevada, 29th.

*Northern plateau.*—Boisé City, Idaho, 8th, 13th, 18th.

*North Pacific coast region.*—Roseburg, Oregon, 13th; Albany, Oregon, 29th, 31st; Bainbridge Island, Washington Territory, 29th, 30th.

*California.*—San Francisco, 1st, 2d, 3d, 7th, 12th, 17th, 18th, 21st, 25th; Fall Brook, 1st, 11th, 20th; Los Angeles and Oakland, 21st.

##### LUNAR HALOS.

Lunar halos have been observed in the various districts on the following dates:

*New England.*—1st, 3d to 6th, 10th to 13th, 17th, 19th.

*Middle Atlantic states.*—1st, 2d, 4th, 6th, 8th, 10th to 12th, 25th, 31st.

*South Atlantic states.*—1st, 6th, 8th to 11th.

*Florida peninsula.*—3d, 5th, 6th, 10th, 12th to 14th.

*Eastern Gulf states.*—2d, 5th, 9th to 11th.

*Western Gulf states.*—4th to 6th, 9th to 13th, 30th, 31st.

*Rio Grande valley.*—Rio Grande City, Texas, 31st.

*Tennessee and Ohio valley.*—4th, 5th, 9th, 10th, 12th, 13th, 16th, 22d, 30th, 31st.

*Lower lake region.*—4th, 6th, 10th, 13th.

*Upper lake region.*—1st, 4th to 7th, 9th, 12th, 13th, 30th.

*Extreme northwest.*—3d to 6th, 11th.

*Upper Mississippi valley.*—2d, 3d, 5th to 9th, 14th, 15th.

*Missouri valley.*—4th to 6th, 8th to 12th, 30th.

*Northern slope.*—5th to 9th, 12th.

*Middle slope.*—Fort Elliott, Texas, 5th; Yates Centre, Kansas, and Red Willow, Nebraska, 9th.

*Southern slope.*—Fort Stockton, Texas, 3d, 7th; Fort Davis, Texas, 3d, 5th, 8th.

*Southern plateau.*—Wickenburg, Arizona, and El Paso, Texas, 9th; Yuma, Arizona, 1st, 13th, 14th, 21st.

*Middle plateau.*—Nephi, Utah, 11th; Salt Lake City, Utah, 13th; Carson City, Nevada, 12th, 31st.

*Northern plateau.*—Lewiston, Idaho, 4th; Spokane Falls, Washington Territory, 7th, 10th, 11th.

*North Pacific coast region.*—1st, 3d, 7th to 10th, 12th, 13th.

*California.*—Fall Brook, 1st; San Diego, 1st, 3d; Los Angeles, 12th.

#### MIRAGE.

Vermillion, Dakota, 12th.

Webster, Dakota, 9th.

Manistique, Michigan, 28th.

Genoa, Nebraska, 9th.

Indianola, Texas, 2d, 13th.

Pretty Prairie, Kansas, 9th, 12th, 26th.

Prof. Cuthbert P. Conrad, of Fayetteville, Arkansas, furnishes the following report:

On the evening of February 26, 1884, a phenomenon known locally as "weather lights" was the precursor of a violent snow storm. I have watched these "weather lights" in this locality for four years, and, while I have lived in five states east of the Alleghanies, have never witnessed similar phenomena elsewhere. The appearance is that of rosy red to white light appearing above the horizon, 5°, 10°, and even 30°, and all the way from northeast around to southwest—sometimes only in the northwest (the most frequent quarter); sometimes first in the northeast, fading out and appearing in northwest, west, or southwest.

These lights invariably precede a change in weather—either rain or snow (*i. e.*, a change invariably follows), but I have not been able to fix upon any definite interval of time.

The Chief Signal Officer desires to state that if others have observed similar phenomena, the reports of such observations are desirable.

#### MISCELLANEOUS PHENOMENA.

Concerning the phenomenal appearance of the sky at sunrise and sunset, which has been observed for several months past, the following reports for March have been received.

*Alabama.*—Red sunsets with afterglow were noticed at Auburn, Lee county, and at Tusculumbia, Colbert county, on the 24th and 25th.

*Arkansas.*—Lead Hill, Boone county, 31st: the red sky at sunrise and sunset has nearly disappeared; a faint display was observed on the morning of the 3d and on the evening of the 25th; on the 2d, 3d, 9th, 11th, and 12th, only a white glare was noticed.

*California.*—Hydesville, Humboldt county: during March, the unusual colors of the sky were only observed before sunrise and on the morning of the 3d, and on the evening of the 14th.

*Dakota.*—Webster, Day county: the twilights observed during March were not so bright as those of February, with the exception of the display of the 13th, which was quite brilliant.

*Florida.*—Limona, Hillsborough county: red sunrise on the 3d.

Archer, Alachua county: red sunsets on the 2d, 15th, 26th; red sunrise on the 16th.

*Georgia.*—Forsyth, Monroe county: red sunsets 20th, 21st, 26th, 28th.

*Indiana.*—Vevay, Switzerland county: orange-colored sunrise on the 27th.

*Iowa.*—Humboldt, Humboldt county: red sunsets on the 3d, 13th, and 14th.

*Kansas.*—Wellington, Sumner county, 31st: the phenomenal sunset afterglow was observed on all clear evenings during the month, its brilliancy having decreased to a great extent.

Sherlock, Finney county, 31st: the glow at sunrise and sunset was observed several times during the month, but the displays were fainter than those of November and December.

Allison, Decatur county: the glows at sunrise and sunset, observed during March, were less conspicuous than those seen in the previous months.